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Development and validation of a single collector ICPMS procedure to determine boron isotopeic compositions of water and food samples

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Authenticity and provenance studies as well as issues in environmental- and geo-sciences are hot topics in nowadays isotope research. Elements being known for their natural isotopic variation, such as lead and strontium, are being used to assign the provenance of artefacts, food and other products. A recent study revealed the potential of boron (B) isotopes for delivering information on the provenance of crop plants. To offer alternative analytical instrumentations beside the classical TIMS procedures a single collector ICPMS procedure for B isotope analyses has been developed and validated. This procedure should enable more B isotope studies, as single collector ICPMS intruments are more widepread in the relevant laboratories compared to TIMS.
The developed procedures for the determination of B isotopic compositions use a magnetic sector ICPMS and consist of one low resolution (LR) and one medium resolution (MR) procedure. The absolute standard deviation for the 11B determination in three independently measured samples lies between 0.2 and 0.8 %■ for the LR and between 0.3 and 1.5 %■ for the MR. The expanded uncertainties with a coverage factor of k=2 range between 1.4 and 1.6 %■ for the LR and between 2.9 and 3.2 %■ for the MR. The trueness, expressed as average deviation from the reference values, is less than 1.1 %■ for LR and 0.8 %■ for MR. To test the practicability of the procedure the matrix tolerance has been investigated. Using a measurement solution containing 100 μg/kg boron a matrix of 2 mg/kg of alkaline and earth alkaline elements was found as a limit for stable instrumental mass discrimination. Thus a highly efficient matrix separation is required, similar to TIMS.
The developed procedure is well suited for the for B isotope studies of various matrices and especially the LR procedure offers relatively small uncertainties combined with high sample throughput.